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OCKLAWAHA NURSERIES

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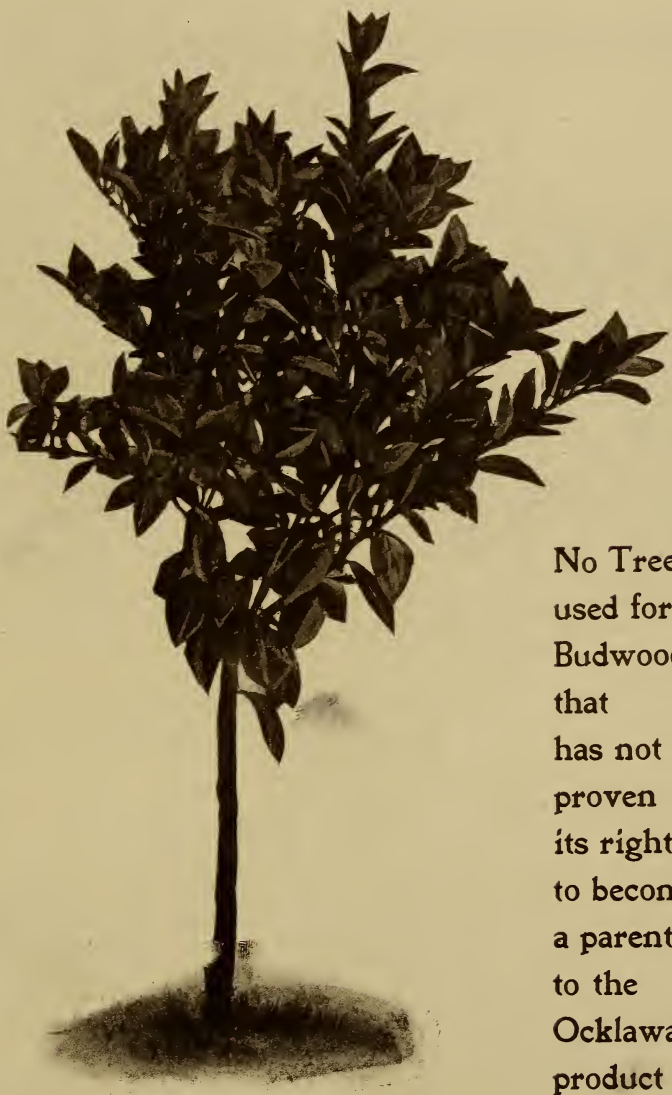
BULLETIN ON BUDWOOD SELECTION

Some Pertinent Facts Worthy Your Most Earnest Consideration. Testimony from Those Who Know. Read carefully every word. Then make your grove a "Best Producer" by planting Ocklawaha Nurseries Pedigreed Trees.

Compiled by O. W. CONNER.



Every Tree in our whole stock budded from a Tested Parent Tree

No Tree used for Budwood that has not proven its right to become a parent to the Ocklawaha product

A Pedigreed Tree

Get into line. Demand trees propagated right from your nurseryman and be sure he does it. Investigate our way.

(Third Edition, 1000 Copies)

BUDWOOD SELECTION

Extract from Paper Read in Citrus Seminar, Gainesville, Fla., October 5-8, 1915, by Prof. Leo D. Scott, U. S. Bureau of Plant Industry, and Published in Florida Grower under date of October 16, 1915

Supplemented by an Appeal to Your Reason by O. W. Conner

CONCEPTION AND DEVELOPMENT OF SCIENTIFIC BUD SELECTION INVESTIGATIONS

Florida citrus growers are all, no doubt, somewhat familiar with the bud selection investigations which the Office of Horticulture and Pomological Investigations of the United States Department of Agriculture has been conducting for the past few years with citrus and deciduous fruits. Different phases of the investigation have been presented from time to time in The Florida Grower and other publications. However, in view of the fact that some may not be familiar with these investigations, a brief description of the conception of this work and its subsequent development may not prove amiss at this time.

Fifteen or twenty years ago a young man working in Illinois worked out the principle of careful seed corn selection. That man, Mr. A. D. Shamel, afterwards entered the government service, and did very notable work with tobacco, cotton, asparagus and other plants by selecting disease-resistant strains and strains showing other desirable characteristics. About seven years ago Mr. Shamel was transferred from the tobacco investigational work to the Office of Field Investigations in Pomology, as it was then known. He was sent to California and assigned to the scientific staff working under the direction of Mr. G. Harold Powell, who was then investigating the handling and storing of oranges in that state.

In the course of his work Mr. Shamel visited groves in the various sections of California, and in doing so he was struck with the marked differences among individual trees in these groves. Some trees, he would notice, were loaded with fruit, while other adjoining trees were practically barren. He asked different ones to explain this condition, but received very unsatisfactory answers. Many of the growers would say that the trees which appeared to be light bearers at that time had borne excessive crops the year before. When Shamel asked them for proof of this assumption, they would reply that in view of the fact that the tree bore no fruit that year, it must have been an excessive bearer the preceding year. Shamel, however, was not so sure of this. He found in grading and sorting the fruits marked differences in types. Some oranges were smooth, thin skinned, while others were very rough, coarse and corrugated. He talked the matter over with Mr. Powell and later with Dr. Galloway, then chief of the Bureau of Plant Industry, and secured a small appropriation to study the variations existing in citrus fruits and to see whether or not by careful bud selection these differences could be propagated.

SIX YEARS' RECORDS PROVE MARKED DIFFERENCES IN TYPE DUE TO CARELESS BUD SELECTION

The first investigations were commenced with Washington navel oranges and Marsh seedless grapefruits in the vicinity of Riverside, California. After two years' work with these varieties other varieties were included in the investigations—viz., Valencia oranges, Eureka and Lisbon lemons. At the present time, six years' records have been secured on approximately one thousand Washington navel trees and over a hundred Marsh seedless grapefruit trees. Four years' records have been secured on

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about four hundred lemon trees and over two hundred Valencia orange trees. The writer became associated with this project about four years ago.

The investigations have naturally fallen into three important divisions:

This photograph, taken in our test grove, shows the result of propagating from bearing trees. Average number of boxes to the tree, 20; age six years; variety Conner Prolific; no off sizes, no off grade. Our Conner Prolific Grapefruit budded almost entirely from this acre of trees.

1. A study of variations existing among trees of any given variety under the same cultural and other environmental conditions. The work has progressed far enough to prove beyond any question of a doubt that these variations do exist in marked numbers.

2. Is it possible to propagate these differences by careful bud selection?

3. Will the differences so propagated be consistent from year to year in the young trees?

As a result of these investigations it has been found in the case of the Washington navel orange that there are eleven or twelve different types; there are at least eleven types of Valencia oranges, five or six of Eureka lemons and five or six of Lisbon lemons. Now, just what do we mean by the word "type"? We have used that word (possibly some other would be better) in referring to any variation in a standard variety which occurs with considerable frequency in a number of different sections. These differences in type are sometimes confined to differences in fruit characteristics, others are confined to differences in habit of tree growth, and still others to differences of production. Generally a difference in habit of tree growth is correlated with a corresponding difference in the fruit. **Take the Valencia orange for example. One type of tree bears standard Valencia oranges. This type we have found to be productive from year to year. Often adjoining it we will find trees which bear apparently nearly as good quality of fruit, but are alternate bearers—one year having a good heavy crop and the next year bearing practically nothing. Other nearby trees will bear corrugated fruits that are thick-skinned, coarse texture, poor**

quality and practically worthless. Still other trees will bear long type fruits and others thin skinned ones resembling a paper rind St. Michael.

RECORD NOT BASED ON THEORY, BUT FACTS

The question naturally arises: Could not these variations in types of fruits be explained by differences in cultural methods, or in soil conditions? To avoid such complications as this in the locations of our experimental plots, we always try to take a block of one hundred trees, if possible, which show as great a range of variation in types and in production as we can find. In locating these plants, we have always been especially careful to eliminate all soil conditions or other environmental factors which might have some influence on tree production.

Our work has not been based on theory, i. e., simply walking through a grove and picking out different types of trees and assuming that these various types of trees produce such and such crops each year. We have picked each one of our experimental trees separately and kept track of the yield from each tree for a series of years, so any statements we make concerning differences in tree yields are not the result of theoretical observation, but of actual work with the trees and fruits themselves.

Take our orange work, for instance, as an example. We have a small mechanical sizer similar to those used in the packing houses which we move from plot to plot in the grove. We sort the fruit from each tree into a first and second grade and by means of the sizer separate that fruit into the commercial sizes ranging from 288's to 80's. We then count and weigh the fruit in each size in each grade. As a result of this we have found out that the trees which produce the largest amount of fruit also as a general thing produce the best quality and best grade of fruit. That is true of practically all of the varieties which we have had under observation.

RESULTS OF BUDWOOD FROM PRODUCTIVE LIMBS OF RECORD BEARING TREES

Now taking up the second part of our work—the propagation of these differences. In our citrus propagation work we only use bud sticks cut from fruit-bearing wood with the fruit attached, believing that the fruits on the end of a bud stick can be taken as a guide, or an indication as to what you can expect the trees propagated from those buds to produce. Not only do we select good standard type record trees as our source of buds, but by cutting the budwood from productive limbs with the fruit actually present we attempt to eliminate all possibility of propagating undesirable limb variations.

Four years ago without at that time having records on the individual tree production, but simply picking out good standard type Eureka lemon trees and using this method of securing budwood, we rebudded on one plantation three thousand unproductive type trees. Without exception every one of those trees which formerly produced about a box per year of rough, poor quality fruits have now become productive type trees, bearing anywhere from five to six boxes of fine quality fruit. Think what that means. In four years' time worthless, unproductive trees have been successfully worked over to productive type trees simply by securing budwood from fruit-bearing wood on standard type trees.

IMPROVEMENT PERMANENT AND OF VAST COMMERCIAL IMPORTANCE

Now, taking up the third part of the investigation: Are these differences consistent from year to year in the budded trees? The first years the investigations were under way Mr. Shamel propagated from a number of different type navel orange trees. We, therefore, have had at least four years' records on the production of the trees so propagated. In every case differences in types were not only successfully propagated, but these same differences have been very marked from year to year in the young budded trees.

Next and of the greatest importance is the commercial application of these principles: **It costs just as much to take care of a poor type tree as it does to take care of a standard productive tree.** How much better it would be if all the trees in an orchard were carrying possibly not a maximum capacity of fruit, but a good average crop. Unfortunately, as has been shown where a definite system of securing tree records has been practiced, in a number of instances a very small percentage of trees are carried at an actual profit. **One grower who was keeping co-operative records found that only ten per cent of his trees were being carried at a profit to himself, i. e., producing enough fruit to bring in any returns over the actual cost of handling the grove and packing the fruits.** The remainder of his trees were either neutral, or carried at an actual loss to himself.

As a result of the citrus fruit improvement investigations which have been carried on in California, many of the growers there have numbered all of their trees and kept an actual record of the amount and quality of fruit produced by each tree from year to year. When they find a tree after a series of years which is not up to the standard of the rest of the grove, it is rebudded, if it is a healthy tree, getting the buds for this purpose from good standard type trees on which they have actual performance records of the tree's production. If they find a diseased tree, it is taken out and another put in its place propagated in their performance record nursery in which all the buds have been taken from record trees.

INCREASING DEMAND FOR PERFORMANCE RECORD TREES

The work of securing commercial individual tree records has progressed far enough so that we are safe in making the statement that it is just as important for a fruit grower to find out what his individual trees are producing as for a dairyman to know what his individual cow's butter fat production is. There is a growing demand in the various citrus and deciduous fruit sections for trees which have been propagated from performance record trees. Several nurseries in California have taken advantage of this and have secured records on individual tree production, only propagating from trees on which they had definite records of the amount of fruit produced by each tree, and only using fruit-bearing wood as their source of budwood. This spring one of these nurserymen received an order for 3,600 performance record lemon trees at $1.00 per tree. He, however, had sold out all his stock and was unable to fill the order. Many other nurserymen with trees propagated in the old method of simply cutting the buds in the nursery row were unable to dispose of their trees this season.

The fruit improvement investigations have long ago passed beyond the experimental stage. It is only a question of time until methods of securing records of individual tree production, and applying these methods to the successful elimination of unproductive trees, by rebudding from productive ones, will become a common part of all horticultural operations. In fact, we believe that time has arrived. The work that has been done in the past seems to offer almost conclusive proof that the differences in types are present in all our standard fruit varieties.

We who have been connected with the fruit improvement investigations believe that the experimental work done up to date has proven beyond any question of a

A row of Pineapple orange trees four years old. Every tree producing strictly high grade, high class and high type of fruit exactly like that of the parent tree. Trees like these have a future before them.

doubt that this principle will be encountered in all fruit varieties, that all varieties are subject to a considerable amount of variation. However, by a careful system of tree records we can isolate the standard, or ideal types of all our varieties and by a careful selection of buds propagate these desired characteristics.

MAKE YOUR TREES RECORD PERFORMERS

In view of the fact that it has been shown experimentally under California citrus conditions that these differences do exist and also that the productive types can be isolated by means of careful bud selection, and the preliminary work done in other sections points to the same general conclusion, it does not therefore seem feasible or necessary to repeat these experimental dmonstrations in every citrus and deciduous section. It is a matter now for the growers to take up themselves. We would like to see, if that were possible, every citrus tree, every subtropical tree in Florida become a performance record tree. Our office will be glad to do anything in its power to assist in the inauguration of definite systems of securing tree records, but the successful application of these principles will depend upon the growers themselves. Study your own trees. Find the desirable types in your own grove, and weed out the undesirable ones. Apply the Babcock test to your trees and eliminate the drones.

AN APPEAL TO YOUR REASON

Based on Eight Years of Work in Florida

By O. W. CONNER

UNPROFITABLE GROVES LARGELY THE RESULT OF CARELESS NURSERY PRACTICES

After reviewing the above and applying my personal knowledge of conditions in Florida groves that have been planted from five to thirty years I do not wonder that I so often hear the remark made among growers of ordinary experience, or among those who do not understand the importance of the parentage of original trees as to variety and bearing propensities used in planting groves, that citrus fruit growing is not a profitable occupation in Florida; that it costs more to take care of a grove and pay the bills than one gets from the output of the grove, etc.

In my experience of over twenty-five years in Florida I have seen every scientific feature of propagation entirely and absolutely ignored so many times and so almost universally that I wonder that the large number of profitable groves exist in the state, as apparently does, because Florida growers have so largely purchased their trees in such a careless manner as far as the future product has been concerned, and the usual work done by the nurseries in the state has been so carelessly done and with so little regard for what the trees they produced would perform in the future, that it would seem impossible that good results could be obtained.

PRACTICE OF USING NURSERY TRIMMINGS DETRIMENTAL

Even were it possible to obtain nursery trees true to name where the practice of using trimmings from the nursery for budding purposes into new stock is followed we know that it is impossible to have such budwood develop into bearing trees that will bring forth fruit uniformly true to the type the name would indicate. It is absolutely impossible for nursery trimmings to produce the same type of tree, and as far as that is concerned the same variety, without wide variations that break up the general characteristics of the variety used.

In varieties like the **Pineapple orange** the fruit will vary from the finest color, size and texture to the coarsest seedling fruit in a run of four or five years from the original tree bearing a high grade of fruit where each year thereafter the nursery stock is depended upon as a source of budwood. Whereas, if each year the budwood for the **Pineapple variety** is taken direct from the bearing trees there will not be any year over two to three per cent variation from the highest grade of fruit possible to obtain year after year from a selected type bearing Pineapple orange tree. And every year that bud selection from bearing trees is followed the output of the nursery will be of the same fine characteristics that make it a profitable tree to have in your grove.

OUR TESTS SHOW ONLY 55% PINEAPPLE TRUE TO STRAIN WHERE NURSERY TRIMMINGS WERE USED

We have in our test groves a row of eighteen Pineapple orange trees, the budwood for which was cut from nursery stock four years removed from the original bearing trees, and only 55% of those trees are producing fruit that in any way compare with the original strain. There has been grove after grove of Pineapple oranges planted in Florida from trees propagated in this way that have been so faulty in their fruit product that the variety represented by the packed fruit has been so seriously questioned as to cause law suits at the receiving end to recover damages, because Pineapple oranges were not contained in a carlot shipment from a Pineapple orange grove planted in good faith by a grower whose trees were sold to him by a nurseryman who considered them to be Pineapple and who thought they were Pineapple, because he had always stuck to one strain by budding it year after year from his nursery stock.

VALENCIAS SHOW LARGER PER CENTAGE OF DETERIORATION

In **Valencia Late oranges** the variation as to type where propagation is made from the nursery year after year is so great that a grower who is at all particular would be disgusted with the production of Valencias and wish thousands of times that his grove had been anything else.

We know of one association shipping Valencia Late oranges, where practically all the trees in that locality had been planted from nursery-cut budwood, that had 67% off sizes and off grade fruit from their entire production.

In our own test groves we have the trees fruiting, growing side by side and budded by both methods, i. e., from nursery stock trimmings and from selected budwood from trees bearing a standard high grade of fruit. Where the selections were made from the bearing trees the product of the young trees is absolutely uniform all over as to size, color, shape and quality, as well as to season of ripening. The trees budded from nursery-cut budwood show such a wide range of variation as to type and season of ripening that the trees in that block could hardly be recognized as one and the same in variety with the trees in the selected block.

A four-year-old Valencia Late orange tree planted on our grounds from our nursery stock, special propagation. Absolute uniformity, size, shape and color.

$1600 PROFIT PER ACRE OF GRAPEFRUIT DIRECT RESULT OF SELECTED BUDWOOD

In our grapefruit of **Conner Prolific** and **Marsh Seedless** varieties the same comparative value is well represented. In blocks of trees resulting from selected budwood we have a tree producing the largest quantity and the best quality of grapefruit that I have ever seen on any trees in the state, and because of their performance during the season of 1914-15 our acreage of **Conner Prolific** and **Marsh Seedless** grapefruit yielded a profit of $1600.00 per acre, while at the same time and during the time that we were shipping our fruit we

noted in various parts of the state hundreds and hundreds of boxes of grapefruit of such a quality that it remained on the tree or fell to the ground a total loss to the grower.

Marsh Seedless grapefruit, producing heavy crops, perfect and true to type

OCKLAWAHA NURSERY TREES MOST ECONOMICAL TO BUY

In the face of our successful experiments along the line of tested out varietal selections of budwood and its importance to the young trees, do you wonder that the **Ocklawaha Nurseries** are putting forth a special effort in the direction of budding a high grade and a high type of tree for the Florida planters' use and at the same time making that tree so expensive that it cannot be sold in competition as to price with other stock produced in the state? Does it not strike you that it would be a bad business policy for the Ocklawaha Nurseries to follow if they did not expect to be able to impress upon the minds of the planters of new groves in Florida the absolute necessity of using trees grown in the way that they are grown at the **Ocklawaha Nurseries** if they expect to make a profitable grove on the lands that they are planting to citrus fruits today?

Does it not strike you that if the **Ocklawaha Nurseries** were doing business for the purpose of selling trees for profit alone and without any regard as to what became of the planter after those trees were sold and we had the money for them, that we would follow the same cheap methods that are being followed by so many other nurseries in the state and enter the field in a competitive way as to prices and sizes of trees and by that means have a much less effort on our part and entirely without the need for educating the planter without experience as to what would be best for his future success to use in planting his grove?

Do you not think that the success pointed out by the experimental work done by the United States Bureau of Plant Industry in the direction of proving the value of bud selection for growing trees and producing fruit crops is a sufficient proof to cause you to spend the $15.00 to $30.00 per acre more for trees that they have proven to be the only desirable trees to use in planting, and have your grove based from the very start on a foundation to win success for you in the production of plenty of high grade citrus fruit?

VALUE OF PEDIGREED TREES PROVEN

We have certainly proved the value of pedigreed trees in our own groves. And when we say "pedigreed" we do not mean that a certain strain has been followed from the original tree for a certain number of years, but we mean that the parent tree **has been selected when the fruit was ripening on the trees and when both tree and fruit were found satisfactory and uniform year after year in the grove, that the tree had been selected and marked for budwood purposes and that budwood is**

cut from that tree and used in Ocklawaha Nursery stock exclusively for propagating each and every tree produced on our place; and that budwood is so cut each and every year from the original tree in order that we may obtain a tree in our nursery of a known quality and quantity of production.

By this means of propagation every young tree in our nursery stock after the first year's growth developed the same characteristics as to foliage that is obtained on the bearing, parent tree, that is, the wood is hard and firm, the growths are slender and willowy, the leaves of the same general character, and you would think to look at that tree that you were looking at a miniature bearing orange tree because of the remarkable resemblance to its parent.

NURSERY TRIMMINGS CANNOT PRODUCE TREES TRUE TO TYPE

A nursery tree grown from nursery trimmings is nothing more or less than a big, robust water sprout tree. It has none of the characteristics of the original strain because it has been propagated year after year from the largest and plumpest buds possible to obtain from the new growth on a thrifty growing tree in the nursery, and the only point of preference that could possibly be exercised for such budwood would be that it is more easily cut and inserted under the bark of the seedling for the purpose of getting a quick, rapid growth that will insure a large, heavy caliper tree in the shortest possible time and growth at the least possible expense. That would be the better plan of propagation were size the only consideration, but who wants to plant a tree at any price because of the size alone represented in that tree? It would be a fine thing if both size and quality could be incorporated by this method of propagation, but it is just as impossible to get a tree grown from water sprout budwood to produce fruit of uniform varietal qualifications as it would be to get a goose to lay hummingbird eggs.

OCKLAWAHA TREES DEPENDABLY TRUE TO TYPE IN SIZE, SHAPE, COLOR AND TIME OF RIPENING

We do not hesitate to say to you that in trees propagated at the Ocklawaha Nurseries you will be able to obtain Valencia Late oranges of uniform size, color and shape, together with the proper season of ripening; and with Pineapple oranges every tree planted produces that fine, rich color, aroma and good size that will make them valuable as a market proluct each and every year you own them; that Ruby Blood oranges will be also uniform in size and shape and that when they mature and ripen to the proper degree that every orange that is exposed to the sunlight will show ruby red through and through. Your Tangerines will be fine and large, well colored, and other varieties propagated will be of the same degree as to quality and qualifications as to variety that we have enumerated above for other types.

You will find your Marsh Seedless grapefruit both seedless and late as to season of ripening. Your Conner Prolific grapefruit will be of that excellent type that will warrant them in being placed on the market at a profit because they are smooth, fine grained and early and the product of the tree ripens uniformly and evenly. The Improved Conner Prolific grapefruit we have every confidence in as an early type and at this time, October 20, 1915, notwithstanding the lateness of the season occasioned by dry weather through July, August and September, this variety is showing almost entirely ripe on the trees.

In the Conner Seedless orange we feel perfectly satisfied and our propagations are being improved with this new strain each year as we are able to make better selections from the bearing trees, based on their product in fruit under comparative tests in the grove.

As ours is a scientific work, requiring a great deal of study and a great deal of education among planters who do not know, we are sending out this bulletin in the hope of getting greater interest along the line of our endeavor and greater support among the planters of new groves.

THE FLORIDA GROWER A GOOD WEEKLY

The Florida Grower, a weekly paper, closely allied with all interests along the line of development, and especially new developments, in the State of Florida, has followed closely all work done by the U. S. Bureau of Plant Industry, and has published the results of the experimental work done in California by Prof. Shamel, Prof. Pomeroy and Prof. Scott, and accompanying this bulletin is an extract from one of the reports made by Prof. Leo. Scott, of the U. S. Bureau of Plant Industry,

at the Citrus Seminar, held at Gainesville, Fla., October 5th to 8th, 1915, and the entire report is contained in the issue of The Florida Grower dated October 16, 1915. Other reports have been issued under dates of November 28th and December 12th and 19th, 1914. No grower in Florida should by any means be without The Florida Grower. It is published at Tampa, Fla., by the Florida Grower Publishing Co. and the subscription price is $1.50 per year. Send for it now.

Trusting that all this will be of interest to you and that we may hear from you on some of the points raised in this bulletin, and assuring you that our aim is for your entire success along the line of citrus fruit growing in Florida, I beg to remain,

Sincerely yours,
O. W. CONNER.

In further evidence of the vast importance of bud selection we present below extracts taken from an article prepared by Prof. C. S. Pomeroy and appearing in The Florida Grower, December 19, 1914.

Please read carefully every word.

BUD SPORTS EXPLAINED **Bud sports, bud mutations, or bud varieties are terms which are applied to the variations found in plants that are propagated vegetatively. These variations may consist of differences in color or character of the bloom, of changes in shape, size, color, ripening period, quantity or quality of fruits, of variegated, curly or cut-leaf forms, of weeping, or other upright habit of growth, color of branches, the elimination or addition of thorns, in-**

Special selection terminal wood propagation to obtain large size Pineapple oranges. Every fruit perfect in every way; tree four years old.

creased or decreased vigor of growth, or of modifications of any of the other numerous characters of plant growth. The sport may appear as a variation affecting the entire plant, or a large or small part of it.

One of the best known examples of a bud sport is the nectarine, which is a smooth fuzzless skinned peach. This originated as a single branch in a peach tree, and duplicates of this sport are continually being found in various parts of the country. Similarly peach sports are frequently seen in nectarine trees.

EVERY BRANCH A BUD VARIETY **All plant growers recognize seed variations and realize that no two seedlings are exactly alike. Just as truly as every seedling may be regarded as a seed variety, so is every branch a bud variety.** Let me repeat what has been said regarding this subject by Dr. L. H. Bailey, one of the foremost horticultural authorities of the present day. (L. H. Bailey, "The Survival of the Unlike," fifth edition.)

"I am now ready to say that I believe bud variation to be one of the most significant and important phenomena of vegetable life, and that it is due to the same causes, operating in essentially the same way, which underlie all variation in the plant world. The chief trouble in the consideration of this subject has been that persons have observed and recorded only the most marked or striking variations, or those which appear somewhat suddenly (although suddenness of appearance usually means that the observer had not noticed it before, and that they had, therefore, thought bud variations to be rare and exceptional. **The truth is that every branch or phyton is a bud variety, differing in greater or lesser degree from all other phytons on the same plant.**"

A six-year-old Pineapple orange tree in our test grove. Parent trees must come up to this before they are used for budwood.

Any one who will give a few moments careful thought to this problem will readily realize that there can be no doubt but that bud sports are of much more frequent occurrence than is commonly supposed.

There are many well-authenticated and unquestioned instances of the occurrence of bud sports which are admitted as genuine, even by the opponents of the mutation theory, but if there was only one such established case, that would be sufficient to discredit the practice of blindly adopting the seedling explanation to account for all new forms. Since bud sports have occurred, there is no reason why they shall not

occur continually, just as frequently, perhaps, as seed variations do, and with this possibility established, it becomes just as necessary to have absolute proof of the seed origin of a plant before it can be classed as a seedling as it is to have undeniable evidence of its bud origin before it can be rightly listed as a bud sport or mutation. For this reason the present accepted explanations of the seedling origin of many of our fruits and other varieties are open to grave question and doubt in the minds of those who have studied this subject carefully.

As early as 1865 Carriere gave a descriptive list of 154 named varieties of plants of commercial importance in France which had originated as bud sports. Many of the best-known roses, carnations, chrysanthemums, violets and other garden plants originated in this manner and critical gardeners are always on the watch for such variations. Dr. Bailey asserted in 1906 that there were probably no less than 300 named horticultural varieties of bud origin which were being grown in this country at that time.

STRIKING EFFECTS OF BUD SPORTS A striking example of a bud sport was noticed a few years ago at the Plant Introduction Garden of the U. S. Department of Agriculture, at Chico, Cal.

In an old apple tree of the Porter variety, at Scotland, Conn., a large limb was noticed last year bearing seedless fruits which were also quite different in size, shape, color and quality from the rest of the fruits on the tree. This limb bore similar seedless fruits again this season. Seedless grapes, which originated as bud sports, have also been reported. **The larger part of our investigations regarding bud sports has been conducted with citrus fruits and a great number of very marked variations have been found. These consist of differences in size, shape, texture, color, quality and seediness of fruit, time of ripening and size of the crop, shape and size of the leaves, size of the trees and habits of their growth.** In the Marsh Seedless grapefruit, besides several other types, we have a very seedy form which is found as entire trees or as a few fruits in a standard type tree. Seedless fruits are also found in trees of the seedy type. In the Washington navel orange variety, we have found eleven common distinct types bud mutations of very frequent occurrence. They have been noted in all degrees of frequency on the trees. Only one fruit of a sporting type may be found on a tree, or several fruits of the type may occur on a single branch or scattered over the tree. One specimen of several forms may be borne on different parts of the tree, or different branches may be found, each bearing a different type of sport. The entire tree may be a single mutating form, or its two sides may be different types, and numerous other combinations of two or more of the eleven variations are found. In some instances the entire eleven have been found on single trees, grown from one

An individual Valencia Late orange selected for budwood purposes

bud, and several of them have been noted on each of the two parent trees from which the entire navel planting of the state has originated.

Not only are these off-type fruits of very frequent occurrence in nearly every orchard, but they persist continually, year after year, on the same trees, showing that they are in fact fixed mutations. **In addition to this, in every case where one of these sports has been rebudded into a tree of another type, the new head produced by these buds has been identical in all respects with the form from which the buds were taken.** This is very strikingly shown in the case of a sport in an Eureka lemon tree, which consists of a fair-sized branch bearing green and yellow variegated leaves and striped fruits and branches, the green stripes on the fruits persisting even when they are mature. A standard type Eureka tree was rebudded from this variegated sport, and both the foliage and fruit on the new head are identical with that on the original mutation, so that if they are removed from the trees, it is impossible to tell whether they were produced by the original branch or by the rebudded tree.

CHARACTERISTICS OF BUD SPORTS TRANSMITTED BY BUDDING

Not only do bud sports show as variations in color, shape, size and similar characters, but we have many illustrations which seem to prove that the amount of fruit production is a sporting character and one in which there is very great variation. Moreover, from investigations and practical demonstrations now under way, we have proof that this fruitful or shy-bearing habit can be transmitted by budding. Every one recognizes the variations in yield between different trees, but few have heretofore realized that this character was a constant one with the tree, or that it was hereditary.

From careful, individual tree performance records, kept for four years in a well-known and profitable Washington navel orchard, it was found, as reported by Mr. Shamel at the Fruit Growers' Convention at Davis last June, that the difference in actual net returns to the packing house for the fruit from the highest producing trees over that from the lowest producers, was $417.77 per acre annually.

BUDWOOD SHOULD ONLY BE SELECTED ON PAST PERFORMANCE

The owner of a grapefruit grove in San Diego County observed that a few of his trees produced large crops of fine seedless fruits, while others in the same grove were not only light bearers, but a large proportion of their fruits were of undesirable sizes and very seedy. **For planting a new grove, this grower selected buds from two trees in the original plantation, which had been observed to be very large and consistent yielders of desirable fruits. The new grove is now in full bearing and produces uniformly a large crop of seedless fruits of fine shape and size.** Mr. Shamel could tell of a similar, though much more striking, case, in which he has been interested in the lemon groves of the National Orange Company, at Corona. These low-producing trees have been termed "drones" and "boarders." They have been found to be bud sports of a very undesirable nature, but as they are usually very vigorous and rapid growing, they are always filled with fine budwood. **Some budders, finding such trees, have considered themselves fortunate in being able to get their buds with so little effort, but the grower who has tried to pay expenses from such trees has found himself very unfortunate.** However the vigorous character of these trees makes them well adapted as stock for rebudding, and they can thus be easily eliminated and the grove changed to a productive one in a very few years by top-working them to standard types.

Many more varieties of plants might be discussed which are of unquestioned bud origin. It has been demonstrated that new varieties may originate as bud sports and hence we have every reason to believe that still more forms of more or less value can and will be developed in this manner. However, the introduction of new types is neither our desire or our purpose. What we aim to accomplish is to improve the standard varieties by eliminating the undesirable forms which have become so common among them.

TYPES CHANGE AND CAN BE KEPT PURE AND STANDARDIZED TO UNIFORMITY

One of the most common causes of the so-called "running out" of varieties is the condition of their becoming so contaminated with undesirable types that their uniformity is lost and their production greatly decreased. The purpose of our study of this subject is to enable us to determine how to isolate the standard productive type of a variety and then to control that

type by bud selection so as to hold it true and uniform. This means a greater uniformity of the crop and a greatly increased production without an increase of the acreage planted.

Ex-President Roosevelt grasped the real significance of this investigation and expressed it very tersely in conversation with Mr. Shamel last year, when he said: "What we need in American agriculture and horticulture is a fuller development and more complete utilization of the crops and plants we now have rather than the introduction of any new varieties."

What the Ocklawaha Nurseries Have Done With Some of the Most Prominent Varieties and Types of Fruit

By O. W. CONNER

CAREFUL PROPAGATION ASSURES GOOD CROPS OF HIGHEST QUALITY

In Florida today for the future markets up to date planters are not diversifying their planting to any great extent. Their chief aim is to plant the type of fruit that sells for the most money and that is best adapted to the root that will give the best results on their particular soil. In oranges, Valencia and Pineapple varieties are, for good reasons, strong leaders, and in these two varieties are two distinct types of fruit, while no other varieties coming under our notice have such wide range as to sport variations in so short a space of time.

It has seemed to us as we have progressed with our studies that the younger the tree used from which to propagate and the larger and plumper the budwood used from the young bud or nursery growth the greater the variation. So we have come to consider all or most of the heavy sprout growths from the tops or side limbs of young trees as **water sprout** growth and utterly unfit for any use, and have found budwood selection to be of less benefit taken from the tree as a whole than from the smaller wood at the fruiting ends, and any selection we consider purposeless unless the fruit is on the trees when selections are made.

By following the above plan we have produced trees of both of these varieties, 98% of which produce not only good average crops, but at the same time produce the very best quality. And these trees have been taken direct from our nursery rows and planted on our own grounds and brought into bearing heavily at five years from the bud.

SEASON OF RIPENING INFLUENCED NINETY DAYS BY TWO SPORT BUDS OF GRAPEFRUIT

In **grapefruit** we originated **two types** of **early** fruit in **Conner Prolific** and **Improved Conner Prolific** from Bowen grapefruit, lately known to many as Gillett's Late. These two types are at once a very great improvement over the original and at the same time decidedly early in ripening, while Bowen or Gillett's Late are decidedly midseason to late.

The Improved Prolific was a growth resulting from one particular eye growth on a bearing limb of the original sport growth that produced Conner Prolific.

To follow out more closely the result of sport buds I give time of ripening:

Bowen or Gillett's Late, December 15th to February 1st. Original Conner Prolific, November 1st to 15th. Improved Conner Prolific, September 15th to October 15th.

Here we have a difference of **ninety days** in season as a direct result of two sports **from the original seedling type.**

In our work with Marsh Seedless we are dividing our time and talents to pro-

duce, first, a very late type to correspond with the ripening season of Valencias, and to produce a strain absolutely seedless. We are succeeding with both to a remarkable degree and at the same time vastly improving the type by **bud selection from bearing trees.**

The greatest value of our work to the planter of new groves lies in the fact that we are continually planting new groves from our newest propagations and proving our work as we go along, and constantly propagating in our nurseries from our very best strains, from all of which the purchaser of our stock gets the direct benefit. And again we say to you what is absolutely true:

"No nursery tree is a first-class tree unless budded from a bearing tree of a known quality and quantity of production."—O. W. Conner.

We Have Convinced the Most Skeptical of the Need of Proper Propagation by the RESULTS in Our Groves

SINCE going to press with the first edition of this bulletin we have entertained at our nurseries and test groves hundreds of visitors who came here for the express purpose of investigating the merits of our improved methods of propagation applied to citrus fruits. A great many coming here have been skeptical as to the results that would follow budwood selection for the purpose of improving the various known types of citrus fruits. The result has been that not one left here unconvinced after having witnessed the results that we have obtained in groves planted from young trees now in bearing in our test groves and in young nursery stock two and three years old now in bearing in our nursery and which are producing exactly, with every fruit produced, the same type, size, shape and color of that on the fruit stem from which the original propagation was made.

The value of this method of propagation applied to Ocklawaha Nurseries trees has been the means of securing for the Ocklawaha Nurseries the business of the most careful fruit growers in the state for the season of 1915-16. An investigation of what we are doing will certainly lead you to place your orders with us for trees. This is to your benefit, because you can cultivate, fertilize and otherwise take care of your young grove with full confidence that the result of your labors will amply justify your choice of trees.

When the product of your grove reaches 400 boxes to the acre we bespeak an income of from $200 to $400 per acre more for your fruit when Ocklawaha Nurseries trees are used than you would receive if you used trees propagated in the ordinary way from any other source of supply.

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